DUIS :- DIFFERENTIATION UNDER INTEGRAL SIGN

DUIS rule 1:

If I(α)=$\int_a^b f(x,\alpha)dx,\ then\ \frac{dl}{da} = \int_a^b \frac{\partial}{\partial a} f(x,\alpha)dx$

DUIS rule 2:

If I(a)= $\int_{a(\alpha)}^{b(\alpha)} f(x,\alpha)$dx where a and b are the f(α)

$$\frac{dl}{da} = \int_{a(\alpha)}^{b(\alpha)} \frac{\partial}{\partial a} f(x,\alpha)dx + f(b,\alpha)\frac{db}{d\alpha} - f(a,\alpha)\frac{da}{d\alpha}$$

Error Function:-

1) Error Function :-

$$\text{erf(x)}=\frac{2}{\sqrt{\pi}}\int_0^x e^{-u^2}du$$

2) Complementary error function

$$\text{erfc(x)}=\frac{2}{\sqrt{\pi}}\int_x^\infty e^{-u^2}du$$

3) erf(∞)=1

4) erf(0)=0

5) erf(x)+erfc(x)=1

6) erf(-x)=-erf(x)

7) erf(x)= $\frac{2}{\sqrt{\pi}}\left[x-\frac{x^3}{3}+\frac{x^5}{10}-\frac{x^7}{42}+\cdots\right]$

Curve Tracing

Equation of curve	**Formula for integral calculus:**
$\boldsymbol{y=f(x)}$	$s=\int_{s1}^{s2}\sqrt{1+(\frac{dy}{dx})^2}dx$
$\boldsymbol{x=g(y)}$	$s=\int_{y1}^{y2}\sqrt{1+(\frac{dx}{dy})^2}dy$
$\boldsymbol{x=f_1(t)},$ $\boldsymbol{y=f_2(t)}$	$s=\int_{t1}^{t2}\sqrt{(\frac{dy}{dt})^2+(\frac{dx}{dt})^2}dt$

$\boldsymbol{r = f(\theta)}$	$s = \int_{\theta 1}^{\theta 2} \sqrt{r^2 + (\frac{dr}{d\theta})^2 d\theta}$
$\boldsymbol{\theta = f(r)}$	$s = \int_{r1}^{r2} \sqrt{1 + r^2 (\frac{d\theta}{dr})^2 dr}$